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UNITED STATES DEPARTMENT OF COMMERCE
The Assistant Secretary for Communications and Information
Washington, D.C. 20230

ET Doc. No. 13-49

The Honorable Julius Genachowski
Chairman
Federal Communications Commission
445 12th Street, SW
Washington, D.C. 20554

Dear Chairman Genachowski:

The National Telecommunications and Information Administration (NTIA) provides the following input to the Federal Communications Commission (FCC) in preparation for the FCC's commencement of a proceeding to expand the use of unlicensed devices in the 5 GHz spectrum band. Specifically, NTIA recommends that the Commission take a comprehensive look at the opportunities presented in the 5 GHz band, particularly in connection with ongoing activities to reallocate the 95 megahertz of spectrum in the 1755-1850 MHz band to commercial mobile broadband services. While we are hopeful that the current agency-industry efforts to find ways to share that spectrum are successful, it is important to keep in mind that it may be necessary to relocate federal aeronautical mobile telemetry (AMT) systems from the 1755-1850 MHz band to the 5150-5250 MHz band. NTIA also requests that the Commission utilize the proposed compliance test waveform enclosed with this letter and take into account compatibility issues associated with authorized operations of Unmanned Aerial Systems (UAS) in the 5250-5850 MHz band.

Background

NTIA understands the vital role that Unlicensed-National Information Infrastructure (U-NII) devices play in our telecommunications economy. President Obama, in his June 28, 2010 memorandum directing that 500 megahertz be made available for wireless broadband, said that such spectrum would "enable licensed or unlicensed wireless broadband technologies to be deployed."[1] Congress further recognized the value of unlicensed devices by directing NTIA to study two segments comprising 195 megahertz of the 5 GHz band (5350-5470 MHz and 5850-5925 MHz) for possible use by devices utilizing known and proposed spectrum-sharing technologies.[2] It also directed the FCC to begin a proceeding by February 22, 2013, to allow U-NII devices to operate in the 5350-5470 MHz

[1] Memorandum for the Heads of Executive Departments and Agencies, *Unleashing the Wireless Broadband Revolution* (June 28, 2010), 75 Fed. Reg. 38387 § 1(a) (July 1, 2010), *available at* http://www.whitehouse.gov/the-pressoffice/presidential-memorandum-unleashing-wireless-broadband-revolution.

[2] *See* Middle Class Tax Relief and Job Creation Act of 2012, Pub. L. No. 112-96, § 6406(b)(1),126 Stat., 231 (Feb. 22, 2012) (codified at 47 U.S.C. 1453(b)(1)) (Tax Relief Act). *see also*, United States Department of Commerce, *Evaluation of the 5350-5470 MHz and 5850-5925 MHz Bands Pursuant to Section 6406(b) of the Middle Class Tax Relief and Job Creation Act of 2012* (Jan. 2013), *available at* http://www.ntia.doc.gov/files/ntia/publications/ntia_5_ghz_report_01-25-2013.pdf (5 GHz Report).

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band if certain conditions are met.[3] NTIA understands that the FCC's forthcoming proceeding will address additional band segments across the 5 GHz band, including those already authorized for U-NII devices.

As required by the Tax Relief Act, NTIA, in consultation with the Department of Defense (DOD) and other impacted agencies, completed an initial study, assessing the risk to federal users of authorizing U-NII devices in the 5350-5470 MHz and 5850-5925 MHz bands based on known and proposed spectrum-sharing technologies.[4] The study assumed that the FCC's existing U-NII transmit power control (TPC) and Dynamic Frequency Selection (DFS) regulations would be extended to these band segments. The report suggests mitigation strategies for the identified risks and analyzes whether the strategies would adequately address them.[5] Accordingly, the report identifies key technical issues that need to be addressed by the FCC as part of its upcoming rulemaking.

5600-5650 MHz and 5725-5850 MHz Bands

NTIA's 5 GHz Report discussed results of an investigation into ongoing interference to the Federal Aviation Administration (FAA) Terminal Doppler Weather Radar (TDWR) systems that operate in the 5600-5650 MHz band.[6] These radars provide quantitative measurements of gust fronts, wind shear, microbursts, and other weather hazards for improving the safety of operations in and around 45 major airports. At the request of the FAA, staff from NTIA and the FCC conducted this investigation and concluded that the interference was being caused by U-NII devices and unlicensed devices operating in the 5725-5850 MHz band pursuant to Section 15.247 of the FCC's Rules.[7] These devices operated with building-mounted, high-gain antennas (with unobstructed views to TDWR) for outdoor point-to-point communications links.[8]

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[3] The Tax Relief Act requires that the FCC may make modifications to the rules to allow U-NII devices to operate in the 5350-5470 MHz band only if, in consultation with NTIA, the FCC determines that licensed users will be protected by technical solutions, including use of existing, modified, or new spectrum-sharing technologies and solutions, such as dynamic frequency selection; and the primary mission of federal spectrum users in the 5350-5470 MHz band will not be compromised by the introduction of unlicensed devices. *See* Tax Relief Act at § 6406(a)(2).

[4] *See* 5 GHz Report at 1-2.

[5] The specific language in the Tax Relief Act referred to "risk to Federal users". NTIA's study considered harmful interference to systems operated by federal users as well as systems that are used by non-federal users. *Id.*

[6] *Id.* at 3-4.

[7] 47 C.F.R. § 15.247.

[8] *See* NTIA Technical Report TR-11-473, *Case Study: Investigation of Interference into 5 GHz Weather Radars from Unlicensed National Information Infrastructure Devices, Part I* (Nov. 2010), *available at* http://www.its.bldrdoc.gov/publications/2548.aspx; NTIA Technical Report TR-11-479, *Case Study: Investigation of Interference into 5 GHz Weather Radars from Unlicensed National Information Infrastructure Devices, Part II* (July 2011), *available at* http://www.its.bldrdoc.gov/publications/2554.aspx; NTIA Technical Report TR-12-486, *Case Study: Investigation of Interference into 5 GHz Weather Radars*

The investigation identified the following causes of interference to TDWR:

- unlicensed device did not employ DFS and was modified to operate in the 5470-5725 MHz band;
- U-NII device DFS functionality was available but was disabled by the operator;
- U-NII device DFS functionality performed properly, causing the device to move to an adjacent channel, but still caused interference;
- unlicensed device was not certified by the FCC;
- unlicensed device was not certified by the FCC to operate in the bands authorized for U-NII devices (*e.g.*, 47 C.F.R. § 15.247);
- unlicensed device and antenna combinations were not certified by the FCC;
- U-NII device complied with FCC DFS certification requirements but failed to detect TDWR; and
- U-NII DFS compliance test waveforms did not accurately represent all of the TDWR modes of operation.

To address the interference problems encountered with the U-NII DFS compliance test waveforms, NTIA worked with the FAA to develop modifications to the FCC compliance measurement procedures for U-NII DFS enabled devices. In the enclosed Appendix, NTIA proposes new compliance test waveforms to be used in the certification of U-NII devices. These new waveforms more accurately represent the TDWR waveforms. The interference to TDWR demonstrates the importance of the FCC certification and enforcement processes in preventing harmful interference to federal operations throughout the 5 GHz band. NTIA recommends that the forthcoming FCC proceeding address certification and enforcement issues for all U-NII devices to ensure that all 5 GHz federal systems are protected from harmful interference.

5150-5250 MHz Band

As mentioned above, the 5 GHz spectrum presents opportunities to meet other critical demands for spectrum by federal agencies. NTIA, in conjunction with the federal agencies, performed an assessment of the viability of accommodating commercial wireless broadband in the 1755-1850 MHz band.[9] As part of this assessment, the DOD and the National Aeronautics and Space Administration (NASA) identified the 5150-5250 MHz band as a comparable destination band to relocate their AMT systems.[10] The bands available to federal agencies to accommodate AMT systems, if they must be relocated, are limited. Therefore, the 5150-5250 MHz band may become the destination

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from Unlicensed National Information Infrastructure Devices, Part III (June 2012), *available at* http://www.its.bldrdoc.gov/publications/2617.aspx.

[9] United States Department of Commerce, *An Assessment of Viability of Accommodating Wireless Broadband in the 1755-1850 MHz Band* (March 2012), *available at* http://www.ntia.doc.gov/files/ntia/publications/ntia_1755_1850_mhz_report_march2012.pdf.

[10] *Id.* at 45.

for systems that might be relocated from the 1755-1850 MHz band. NTIA believes the ongoing studies in the Commerce Spectrum Management Advisory Committee working groups will lead to a recommendation this summer as to whether non-federal sharing with AMT systems is possible. NTIA recommends that the FCC refrain from proposing to change the U-NII rules in the 5150-5250 MHz band until NTIA and the FCC conclude how they will address the accommodation of the AMT operations currently using the 1755-1850 MHz band.

5250-5850 MHz Band and Unmanned Aerial Systems

In the 5 GHz Report, NTIA reported that the DOD, the Department of Homeland Security (DHS), and NASA operate UAS in the band 5250-5850 MHz.[11] These agencies utilize this band for UAS communications from aircraft-to-ground and from ground-to-aircraft. These systems support a variety of missions including, drug interdiction, intelligence, surveillance, and reconnaissance, combat search and rescue, laser target designation for precision strike by manned aircraft, convoy and raid over-watch, and real-time full-motion video for target development. The agencies conduct tests and training for these missions at sites in the United States. Some also conduct drug interdiction and border surveillance operations in parts of the United States. While there is no frequency allocation for aeronautical operations in this band, NTIA has authorized federal agencies to operate UAS throughout the United States pursuant to its authority under the Communications Act of 1934 and the NTIA Organization Act.[12] Any proposal by the FCC to change the U-NII rules in the 5250-5850 MHz band must address compatibility issues associated with UAS operations.

Thank you for your consideration of these matters. If there are any questions regarding these recommendations please feel free to contact me or Karl Nebbia, NTIA Associate Administrator of the Office of Spectrum Management.

Sincerely,

Lawrence E. Strickling

Enclosure: Appendix - Proposal for New Unlicensed National Information Infrastructure Dynamic Frequency Selection Certification Waveforms

[11] *See* 5 GHz Report at 4-2, App. C-2.

[12] *See* 47 U.S.C. §§ 305(a), 902(b).

APPENDIX

PROPOSAL FOR NEW UNLICENSED NATIONAL INFORMATION INFRASTRUCTURE DYNAMIC FREQUENCY SELECTION CERTIFICATION WAVEFORMS

During the Terminal Doppler Weather Radar (TDWR) interference investigation testing perfromed by NTIA, it became apparent that the Bin 1 Waveform currently used by the FCC for DFS certification testing does not accurately represent the actual TDWR waveforms. To alleviate this problem, NTIA is proposing new waveforms that not only duplicate currently used TDWR waveforms but also include a random element to help protect the TDWR should any improvements be made to the system in the future if and when its waveform parameters are changed.

The existing DFS certification protocol for the Bin 1 Waveform requires that a minimum of 30 trials be performed with each trial consisting of a single burst of 18 pulses each 1 microsecond (μs) long with a fixed pulse repetition interval (PRI) of 1428 μs from each pulse to the next.

To more accurately emulate the transmitted TDWR waveforms, NTIA developed a set of new Bin 1 Waveforms. Replacing the fixed 1428 μs PRI and 18 pulses in a burst is a variation of PRI and number of pulses that follows the guidelines provided in Table 1. The pulse width remains at 1 μs.

Table 1. Proposed Bin 1 Waveform Certification Test Protocol for DFS Certification.

Test	Pulse Width (Microseconds)	Pulse Repetition Interval (Microseconds)	Number of Pulses
A	1	15 unique PRI values randomly selected from the list of 23 PRI values currently used by the TDWR shown in Table 2.	$\text{Roundup}\left\{\left(\frac{1}{360}\right)\cdot\left(\frac{19\cdot10^6}{\text{PRI}_{\mu\text{sec}}}\right)\right\}$
B	1	15 unique PRI values randomly selected within the range of 518 – 3066 μs, with a minimum increment of 1 μs, excluding PRI values selected in Test A	$\text{Roundup}\left\{\left(\frac{1}{360}\right)\cdot\left(\frac{19\cdot10^6}{\text{PRI}_{\mu\text{sec}}}\right)\right\}$

For example if in Short Pulse Radar Type 1 Test B a PRI of 3066 μsec is selected, the number of pulses would be $\text{Roundup}\left\{\left(\frac{1}{360}\right)\cdot\left(\frac{19\cdot 10^6}{3066}\right)\right\} = \text{Roundup}\{17.2\} = 18$.

The new Bin 1 Waveform certification test protocol is broken into two parts, or tests. Test A consists of waveforms that use existing TDWR parameters. Test B consists of waveforms whose PRI values will be chosen randomly in 1-μs increments from the range of 518 μs – 3066 μs. This PRI range spans the existing range of current TDWR PRI values and provides the flexibility to add future radar waveforms. In Table 1, $PRI_{\mu s}$ refers to the PRI value in microseconds.

Additionally, if more than 30 waveforms are required for the Bin 1 Waveform testing then each additional waveform will be generated using the methods described for Test B and must also be unique and not repeated from the original 30 waveforms from either Tests A or B.

Table 2 - Pulse Repetition Intervals Values for Test A

Pulse Repetition Frequency Number	Pulse Repetition Frequency (Pulses Per Second)	Pulse Repetition Interval (Microseconds)
1	1930.5	518
2	1858.7	538
3	1792.1	558
4	1730.1	578
5	1672.2	598
6	1618.1	618
7	1567.4	638
8	1519.8	658
9	1474.9	678
10	1432.7	698
11	1392.8	718
12	1355	738
13	1319.3	758
14	1285.3	778
15	1253.1	798
16	1222.5	818
17	1193.3	838
18	1165.6	858
19	1139	878
20	1113.6	898
21	1089.3	918
22	1066.1	938
23	326.2	3066